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EFFECT OF THE PRUNING ON GROWTH AND PRODUCTIVITY OF TWO GOJI BERRY (*LYCIUM BARBARUM* L.) CULTIVARS

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Abstract

The study was conducted during the period 2017-2019 in the experimental base of the Department of Fruit Growing at the Agricultural University – Plovdiv. At the beginning of the experiment the plants of two varieties of goji berry (JB 1 and JB 2). were in the fifth vegetation. They are formed like trees with a stem height of 70 cm, leader branch, with seven fruiting shoulders and a supporting structure. The aim of the study is to trace the influence of different strength of pruning (winter) on the vegetative growth and fruiting of the studied varieties. For each variety, two variants of pruning were tested, respectively strong and weak.

At the beginning of the experiment in the variant with strong pruning, the fruiting shoulders were shortened to 10 cm in length, and the shoots from the previous year on them were shortened to 5 cm each year. In the variant with weak pruning, the fruiting shoulders were left with a length of 30 cm, and the branches from the previous year on them are shortened to 10 cm each year.

The observed indicators were: stem diameter, crown diameter, crown volume, mass of the cut wood, yield and mass of the fruit.

It was not found influence of the strength of the pruning on the vegetative and reproductive manifestations of the trees. The average yield of fresh fruit (kg/tree) in the tested pruning variants from JB 1 is from 1.19 kg to 1.29 kg, respectively for strong and weak pruning and for JB2 for the same pruning options 0.89 kg and 0.88 kg.

In the conditions of the experiment it was established that in both varieties the tested variants of pruning do not lead to significant difference in fruit yield and vegetative growth.

Keywords: *Lycium barbarum* L., pruning, growth, productivity

INTRODUCTION

Goji berry belongs to the potato family (Solanaceae). The interest in growing the plant is due to its fruits. They contain a huge amount of vitamins, trace elements, proteins, amino acids, polysaccharides, monosaccharides and more. (Van Straten and Griggs, 2006). Initially, studies were performed with seed-propagated plants (Liu, 1999; Zhang et al., 2001; Li et al., 2008), and propagated by cuttings (Shen and Chen, 1990; Zhang et al., 2001; Wang Guirong Kung et. al., 2004; Lu Jia, 2010; Wan-hua, KUI, 2010; Xue et al., 2012; Zou et al., 2013). The varieties in the present study are in vitro propagated. As a cultivated plant Goji berry is grown mainly as a shrub or as a small tree. Growing the plant like shrub has some disadvantages, which are associated with the drooping habit of the plant. The possibility of growing goji berries as a tree would avoid these disadvantages.

There is no information in the available

scientific literature on the influence of strength of the pruning on the growth and fruiting of the goji berry plant formed as a tree, which is the aim of the present study.

MATERIALS AND METHODS

The study was performed in the experimental base of the Department of Fruit Growing at the Agricultural University - Plovdiv with in vitro propagated plants of two varieties (JB 1 and JB 2). At the beginning of the experiment the plants were in fifth vegetation. They were formed like trees on a supporting structure with a stem height of 70 cm and a leader branch, with seven fruiting shoulders. At the beginning of the experiment, the fruiting shoulders in both variants (strong and weak) winter pruning were shortened, respectively to 10 cm and 30 cm. The fruiting shoulders are elongated by 10 cm each year.

During winter pruning, all branches on the fruiting shoulders (upright, growing downwards and

inwards towards the leader branch) are removed from the bottom. During the growing season, in order not to droop the branches, the new growth is pinched at a length of 30 cm.

Two variants of winter pruning have been tested: Strong: the branches from the previous year on the short shoulders (10cm) have been shortened to 5 cm. (Fig.1) and weak: the growths on the branches of the previous year on the long shoulders (30 cm) are shortened to 10 cm. (Fig.2.) The experimental trees are grown under drip

irrigation. Fertilizer 300 g / tree NPK (14:10:12), was given twice a year, first after pruning (March) and then in May before the beginning of the blooming.

The following parameters were studied: Diameter of the stem (30 cm from the soil), mm; crown diameter, cm; crown volume, m³; mass of the pruned wood, g; fruit yield, kg / tree and mass of fresh fruit (50 pcs.), g. Data were processed by the Duncan method.



Fig.1. Weak pruning



Fig2. Strong pruning

RESULTS AND DISCUSSION

Information about the diameter of the stems of the varieties JB 1 and JB 2 for the period 2017-2019 is given by Table. 1. The diameter of the stem increases due to outflow of assimilates from photosynthesis to the thick parts of the tree. The

values of this indicator increase during all years of the research in both varieties in the two tested pruning variants. This trend is well expressed in JB 2 variety in both pruning variants and in JB 1 variety in the variant with strong pruning in which the stem diameter increases from the beginning of the experiment to the last by about 8 mm.

Table.1. Stem diameter of JB1 and JB 2 during the period 2017-2019, mm

VARIANT	JB1			JB2		
	2017	2018	2019	2017	2018	2019
Strong pruning	20.84	23.23	29.00	24.23	28.17	32.00
Weak pruning	18.85	21.05	23.67	24.18	29.44	32.00

The differences are significant $P < 0.05\%$

Table.2. Crown diameter of varieties JB1 and JB2 during the period 2017-2019, cm

VARIANT	JB1			JB2		
	2017	2018	2019	2017	2018	2019
Strong pruning	117,00	105,00	85,00	132.33	105.00	96.67
Weak pruning	123,67	98,33	87,00	132.33	110.60	115.67

The differences are significant $P < 0.05\%$

Analysis of the results of the diameter of the crown of the varieties JB 1 and JB 2 are in Table 2. Crown width in JB 1 decreases throughout all years of the study in both pruning variants. In this variety, the crown is widest in the first and narrowest in the second year of the experiment. The data on the width of the trees show that at the end of the seventh vegetation the trees of both varieties have not yet completely occupied their allotted area in the plantation.

The results of the analysis of the volume of the crowns are presented in Table.3. In the tested

pruning variants for variety JB1 the values of this indicator are in range 0.22m³-0.48m³, and for JB2 0.29m³ to 0.56m³. There is a trend of reducing the volume of the crown in variety JB1 in all years and in both pruning variants. In the other JB2 variety, in the variant with weak pruning the crowns were the narrowest in the second year of the study. The volume of crowns in the last year of the experiment in both varieties is smaller compared to the beginning of the study, which is a result of the drooping habit of the plant.

Table.3. Crown volume of varieties JB1 and JB2 during the period 2017-2019, m³

VARIANT	JB1			JB2		
	2017	2018	2019	2017	2018	2019
Strong pruning	0.44	0.34	0.22	0,56	0,35	0,29
Weak pruning	0.48	0.29	0.24	0,56	0,40	0,44

The differences are significant P< 0.05%

The One-year growth is indicative of the strength of tree growth. The data for the pruned wood is presented in Table. 4. There is an increase in the values of this parameter in all years of the study. This tendency is better expressed in JB 1

when pruned stronger, and in JB 2 in the variant with weak pruning. The wood, which was pruned from variety JB 2 is more than that of JB 1, which is a consequence of the greater thickness of the branches of variety JB2. (Fig. 3-4).



Fig.3 Thickness of the branch JB1

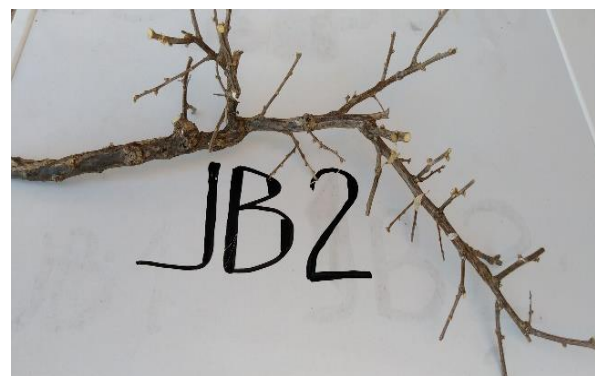


Fig.4 Thickness of the branch JB2

Table.4. Mass of the pruned wood of varieties JB1 and JB2 during the period 2017-2019, g

VARIANT	JB1			JB2		
	2017	2018	2019	2017	2018	2019
Strong pruning	181,64	229,33	260,00	348,60	366,00	386,00
Weak pruning	141,16	285,33	286,67	291,45	316,00	386,67

The differences are significant P< 0.05%

Table 5. Fruit weight (50 pcs.), for the varieties JB 1 and JB 2 during the period 2017-2019, g

VARIANT	JB1			JB2		
	2017	2018	2019	2017	2018	2019
Strong pruning	15,28	20,95	16,92	34,09	37,20	23,18
Weak pruning	16,23	16,72	16,89	34,97	36,71	22,66

The differences are significant $P < 0.05\%$

Information for the mass of fresh fruits (50 pcs.) gives Table 5. The weight of JB 1 fruit during the study period was from 15.28g to 20.95 g. Increase in the values is observed in the variant with weak pruning, while in the strong one, the highest is the mass of the fruit in the second year of the study. In the case of variety JB 2, the weight of the fruit during the study period, which was taken into account from all pruning variants, was in the range 22.66 g - 37.20 g. It can be seen that the fruit weight of variety JB 2 is higher than that of JB 1.

The data for the yield obtained from the varieties JB 1 and JB 2 in the studied variants of pruning during the years of the research are presented in Table. 6. For JB 1 yields decrease over the years for both pruning options. The highest yield of 2.14 kg/tree was achieved by JB 1 in the variant with weak pruning in the first year of the experiment and the lowest 0.62 kg per tree in the last year after strong pruning. The average yield

obtained from JB1 is between 1.19 kg-1.29 kg, respectively in variants with strong and weak pruning.

The yield of JB 2 was the lowest 0.51 kg / tree in the last year in the variant with weak pruning and the highest 1.14 kg/tree in the second year of the experiment. in the same pruning option. The decrease in productivity over the years which was observed in both pruning variants in variety JB 1, in JB 2 is seen in the variant with strong pruning. The lowest yield of JB 2 was obtained in the second year after weak pruning. In this year the crown of JB 2 had the smallest diameter. The average yield for variety JB 2 is from 0.88 kg / tree to 0.89 kg / tree, respectively in the variant with weak and strong pruning. In both varieties in the seventh vegetation is observed a trend of decrease in yields, which is probably associated with a decrease in crown diameter.

Table.6. Yield for the varieties JB 1 and JB 2 during the period 2017-2019, kg / tree

VARIANT	JB1				JB2			
	2017	2018	2019	Average	2017	2018	2019	Average
Strong pruning	1,78	1,16	0,62	1,19	1,01	0,92	0,74	0,89
Weak pruning	2,14	1,03	0,70	1,29	1,00	1,14	0,51	0,88

The differences are significant $P < 0.05\%$

CONCLUSIONS

Under the conditions of the experiment it was not found influence of the strength of the pruning on the vegetative and reproductive manifestations of the trees. The average yield of fresh fruit (kg/tree) in the tested pruning variants from JB 1 is from 1.19 kg to 1.29 kg, respectively for strong and weak pruning and for JB2 for the same pruning options 0.89 kg and 0.88 kg.

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